

# Fuel Cell Report to Congress



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Fuel Cells for Transportation Program  
Fuel Cell Portable Power Workshop  
Phoenix, Arizona  
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# FY02 Interior Appropriations Bill

(H.R. 2217, enacted November 5, 2001)

## House/Senate Conference Report:

***Full Report:*** “The Department should report to the House and Senate Committees on Appropriations, within twelve months of the date of enactment of this Act, on the technical and economic barriers to the use of fuel cells in transportation, **portable power**, stationary, and distributed generation applications. The report should include recommendations on program adjustments based on an **assessment of the technical, economic, and infrastructure requirements needed for the commercial use of fuel cells for stationary and transportation applications by 2012.**”



# FY02 Interior Appropriations Bill

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## House/Senate Conference Report:

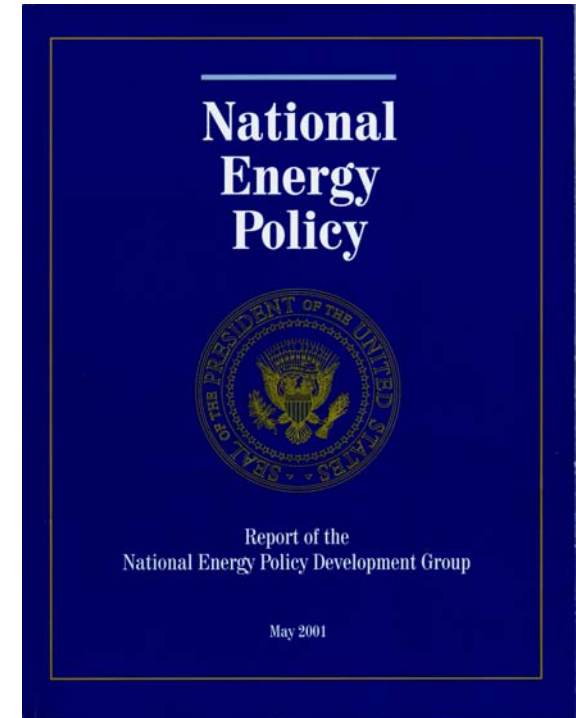
*Interim Report:* “Within six months of the date of enactment of this Act, the Department should also provide an **interim assessment** that describes preliminary findings about the **need for public and private cooperative programs to demonstrate the use of fuel cells in commercial scale applications.**”



# Integration with Other Activities

Recommendations in these Reports to Congress will support:

- DOE/Auto Industry Partnership to develop clean, efficient advanced automotive technologies
- DOE/Industry initiative to develop Hydrogen Vision

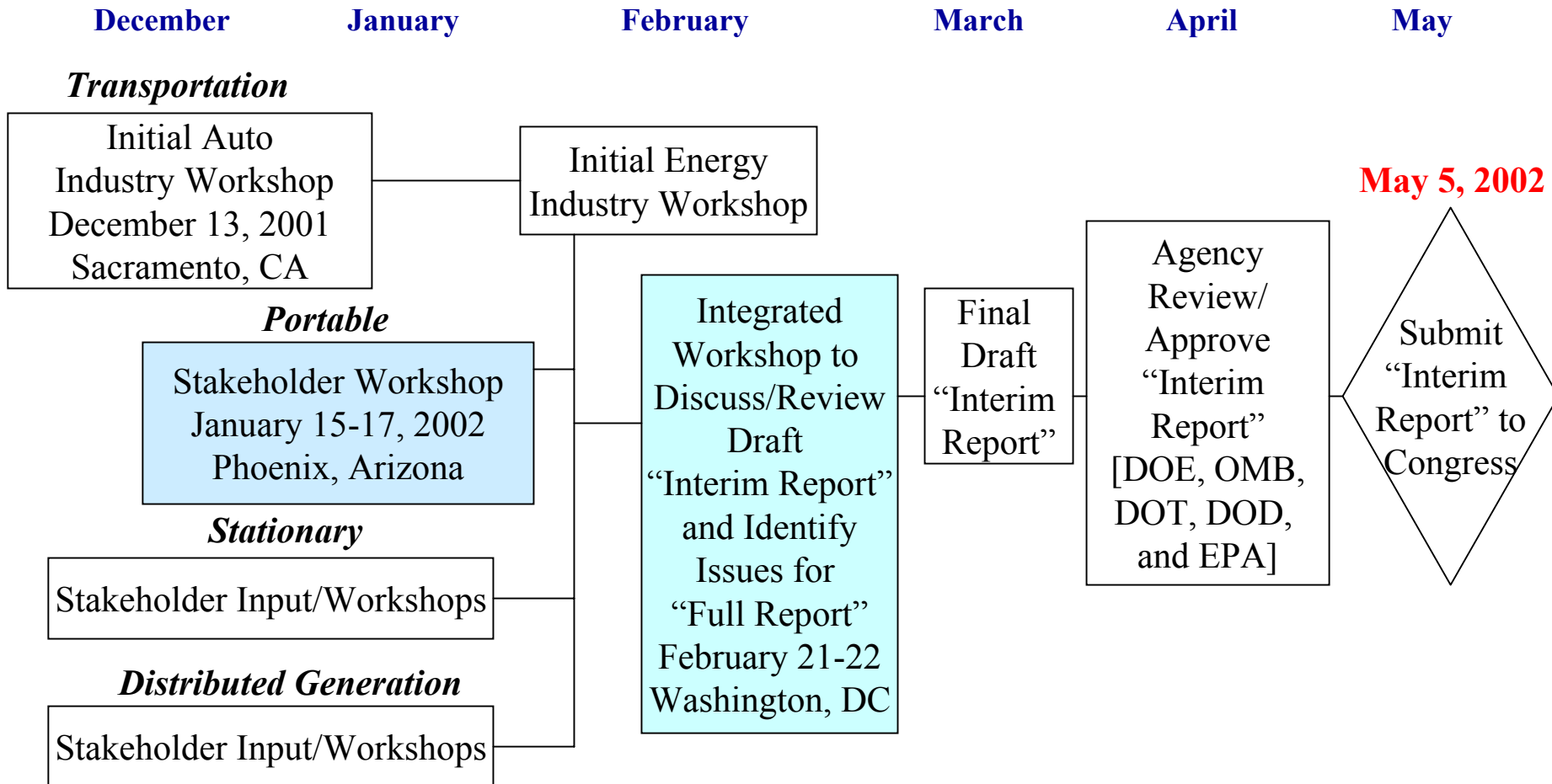


***“The President’s Plan directs us to explore the possibility of a hydrogen economy....”***

***Spencer Abraham, Secretary of Energy***

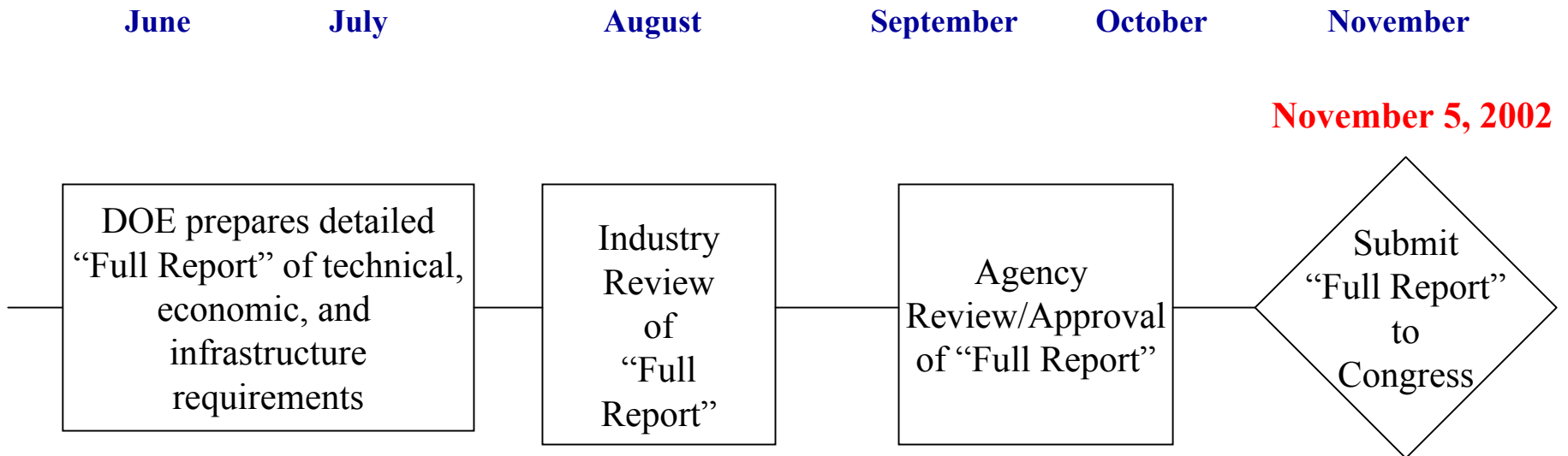


# Process for Developing Reports to Congress





# Process for Developing Reports to Congress





# Preliminary Findings on Necessary Program Adjustments

- DOE will seek to increase its efforts in the following areas:
  - H<sub>2</sub> Storage R&D
  - Infrastructure R&D
- A cooperative effort is needed for assessing and resolving hydrogen infrastructure issues, resulting in affordable, available hydrogen.
- Cooperation is also needed to assess vehicle technology status industry-wide, resulting in affordable, reliable fuel cell vehicles.

*The cooperative program proposed is aimed at accelerating the hydrogen fuel cell vision and is very high risk.*



# Initial Auto Industry Workshop

December 13, 2001 (11:00am - 2:00pm)  
Sacramento, CA during EVAA conference

## Workshop Purpose ...

- describe our process to produce reports
- solicit feedback on preliminary idea for a vehicle related public/private partnership
- get input on appropriate government & industry roles

Participant	Organization
Shigeyuki Kawatsu	Toyota
Stuart Johnson	VW
John Wallace	Ford-Th!nk
Bruce Kopf	Ford-Th!nk
Ray Buttacavoli	GM
Greg Ruselowski	GM
Taro Hagiwara	Nissan
Lance Atkins	Nissan
Ben Knight	Honda
Ferdinand Panik	DaimlerChrysler
Fred Maloney	DaimlerChrysler
Johannes Ebner	DaimlerChrysler
Bill Craven	DaimlerChrysler
Catherine Lentz	CaFCP
Shang Hsiung	U.S. DOT/FTA
Thomas Gross (Host)	U.S. DOE
DOE, ANL representatives	
EVAA representatives	



# Accelerated Timeline to Establish the Capability of Hydrogen Fuel Cell Vehicles

1/3/2002

	2001	Phase 1	2004	Phase 2	2008	Phase 3	2012
	Feasibility Demonstration		Controlled Fleet Demonstrations		Commercial Fleet Demonstrations		Commercialization Phase
Vehicles	Test FC vehicle performance and feasibility		Demonstrate use of FC vehicles under real-world conditions.		Demonstrate commercial viability of FC fleet vehicles.		Investment to establish manufacturing plants and sales/service
Sites	1(CaFCP)		5-8; varying climates		2-3 states (networked sites)		
Number of Vehicles	<50		~500		~5000		
Infrastructure	Demonstrate H <sub>2</sub> fueling station		Onsite generation from multiple feedstocks		Sufficient stations to provide consumer convenience		Investment for 25-50% of all stations H <sub>2</sub> capable
Hydrogen Source	Primarily trucked-in liquid H <sub>2</sub>		Renewables and fossil fuels		Most cost effective sources		
Number of stations	3		5-10		20-30		
Government Role	Share management responsibilities Fuel Chain Analyses Education		Purchase Vehicles Cost share & operate H <sub>2</sub> fueling stations Data collection & dissemination Coordination of international codes & standards Education		Vehicle subsidy Cost shared infrastructure Education		Legislated incentives to consumers & industry  Exercise capability for national energy security
Industry Role	Operate Vehicles and H <sub>2</sub> stations Primary Funding		Vehicle design, engineering & integ. Cost share fueling stations Identify service requirements Complete Codes & standards		Cost share vehicles Cost share fueling stations Gauge consumer acceptance Maintenance capability		Commercialization Phase Begins
Success Criteria [achieved through parallel technology development]							
Fuel Cell	\$325/kW 1000 hrs		\$125/kW 2000 hrs		\$45/kW 5000 hrs		Industry Criteria
Onboard H <sub>2</sub> Storage					\$5/kWh 2000 Wh/kg 1100 Wh/L		Industry Criteria
Hydrogen Infrastructure	\$40/GJ 118 g/km		\$21/GJ 109 g/km		\$12/GJ 98 g/km		Industry Criteria
Cost (@ 500,000/year)							
Durability							
Cost (\$/kWh)							
Energy Density							
Specific Energy							
Cost							
Greenhouse Gases							

*Given the high risk nature of the accelerated timeline, careful decision criteria prior to each phase need to be jointly established by Industry and Government.*



# Feasibility Demo (Phase 1)



This cooperative government/industry phase is already in progress:

- California Fuel Cell Partnership
- Other smaller efforts

## Main Objectives of Phase 1:

- Test research vehicles and gain operating experience with H<sub>2</sub> refueling operations and equipment
- Identify “pathways” to commercialization
- Begin the process of educating the public about transportation fuel cells and hydrogen



**Timeline:** 2001 through 2004 (CaFCP currently discussing post 2003 activities)



# Controlled Fleet Demo's (Phase 2)

Phase 2 transfers vehicle and H<sub>2</sub> generation/station operations from industry technicians to controlled government/military users. Strategic locations will be established with respect to government capability, climate, and energy resources.



## **Main Objectives of Phase 2:**

- Assess performance and reliability of hydrogen fuel cell vehicles in different climates and conditions
- Assess/develop onsite hydrogen generation from multiple feedstocks
- Assess/address economic and institutional barriers

**Anticipated Timeline:** 2004 through 2008



# Essential Components of Phase 2

## (Preliminary Ideas)

- The Federal government could purchase ~500 fuel cell vehicles\* for 5 to 8 strategically targeted sites\* which have control of or capability for power generation, technical and safety expertise, vehicle fleets, service infrastructure, etc.
- The auto industry could bear the cost of electric vehicle design, development, engineering, integration, etc.
- The Federal government and energy suppliers could share the cost of providing multi-feedstock hydrogen generation plants, as well as transmission, storage, and refueling equipment for the vehicles.

\* Optimum number of vehicles/sites needs to be determined based on more refined objectives.



# Essential Components of Phase 2

## (Continued)

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- The Federal government will coordinate data collection and dissemination (with protection of proprietary information).
- Government/industry, in cooperation with global partners, will finalize codes and standards.
- Industry will identify vehicle service and maintenance requirements and emergency response protocol.
- Government/industry will cooperatively establish decision criteria and measure success prior to proceeding to Phase 3.



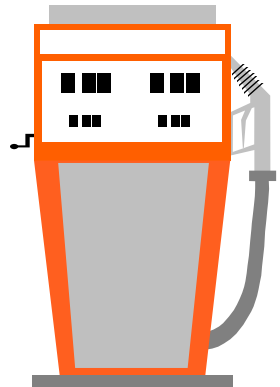
# Commercial Fleet Demo's (Phase 3)

Phase 3 transfers vehicle and hydrogen station operations from “controlled” government users to ***commercial fleet operators***. Networked sites (i.e. multiple H<sub>2</sub> stations) are established within geographic regions.



## Main Objectives of Phase 3:

- Obtain vehicle performance and reliability information necessary to feed into an industry commercialization decision
- Obtain capital equipment and operating cost information (for providing H<sub>2</sub> fuel) necessary to feed into an industry commercialization decision
- Obtain energy and environmental information necessary to support government decision regarding policy support for implementation
- Evaluate customer acceptance of new technologies



**Anticipated Timeline:** 2008 through 2012



# Essential Components of Phase 3

- The Federal government and auto industry could share the cost of purchasing ~5000 fuel cell vehicles\* in 2 or 3 states
- The Federal government and energy providers could share the cost of 20-30 H<sub>2</sub> fueling stations\* so that each selected geographic region has sufficient H<sub>2</sub> availability to support the fleets
- Industry could gauge consumer acceptance of the new technologies

*Important Message: Even if capability is established, rate of market penetration will depend on market conditions.*

\* Optimum number of vehicles/sites needs to be determined based on more refined objectives.



# Initial Auto Industry Workshop Results

- Selected industry comments:
  - Liked process of intensive industry input for generating reports
  - Interested in reviewing and commenting on report
  - Not in favor of vertically integrated teams of fuel suppliers & OEM's competing for govt funding during demonstration phases
  - Fuel source should be left open until start of third phase "commercial fleet demo"
  - Stationary fuel cell commercialization could have positive impact on vehicle commercialization, formal study should be done
- A brainstorming list was developed of the appropriate government role in commercializing fuel cells





# Portable Power Workshop Will Provide Vital Input to Report

## Desired Workshop Products

- Identification of technical barriers that must be resolved prior to market introduction.
- Development of a research, development and demonstration (RD&D) technology roadmap that will facilitate timely market introduction of fuel cell portable power systems.
- Characterization of appropriate roles for developers, end-users and government in the RD&D process.

**Development of a strategy that promotes synergy between portable and transportation applications and that facilitates manufacture and commercialization of PEM fuel cells for all applications.**